

CLAIMS

What is claimed is:

- 1 1. A filter element, comprising:
 - 2 a ring of filtration media circumscribing a central axis and defining a
 - 3 central cavity, the filtration media ring having a first end and a second end;
 - 4 a first, circular end cap having an inner surface sealingly bonded to the
 - 5 first end of the media ring, the first end cap including an annular body portion
 - 6 bounding a central opening into the central cavity of the media, a vent orifice in
 - 7 the annular body into the central cavity at a predetermined location, and an
 - 8 orientation device fixed to and integral with the first end cap and projecting
 - 9 radially outward therefrom; and
 - 10 a second, circular end cap sealingly bonded to the second end of the media
 - 11 ring, a retaining device fixed to and integral with the second end cap and
 - 12 projecting outwardly therefrom.
- 1 2. The filter element as in claim 1, further including a flexible seal bounding the
- 2 central opening of the first end cap.
- 1 3. The filter element as in claim 2, wherein the flexible seal is unitary with the first
- 2 end cap.
- 1 4. The filter element as in claim 1, wherein the retaining device is unitary with the
- 2 second end cap.
- 1 5. The filter element as in claim 1, wherein the first end cap includes a sleeve
- 2 outwardly bounding the peripheral edge of the first end cap, and extending a short

3 distance from the first end cap toward the second end cap, the orientation device being
4 unitary with the sleeve of the first end cap and projecting radially outward therefrom.

1 6. The filter element as in claim 1, wherein the orientation device is unitary with the
2 end cap.

1 7. The filter element as in claim 1, wherein the retaining devices comprise a plurality
2 of individual elements, fixed to and integral with the second end cap and projecting
3 radially outward therefrom.

1 8. The filter element as in claim 1, wherein the retaining device projects axially
2 outward from the second end cap.

1 9. The filter element as in claim 1, wherein the retaining device projects radially
2 outward from the second end cap.

1 10. The filter element as in claim 1, wherein the second end cap includes a sleeve
2 outwardly bounding the peripheral edge of the second end cap, and extending a short
3 distance from the second end cap toward the first end cap, the retaining device being
4 unitary with the sleeve of the second end cap and projecting radially outward therefrom.

1 11. A filter assembly comprising a housing having a threaded open end, a closed end,
2 and a central axis, a first port to direct fluid into the housing and a second port to direct
3 fluid from the housing, the housing including orientation means integral with an internal
4 surface of the housing and projecting outwardly therefrom; a cup-shaped cover with
5 threads adapted to be screwed down onto the threaded open end of the housing, the cover
6 including retaining means internally of the cover; and a filter element removeably
7 disposed within the housing, the filter element including a ring of filtration media
8 circumscribing a central axis and defining a central cavity, the filtration media ring

9 having a first end and a second end; a first, circular end cap at the first end of the media
10 ring, and an annular body portion bounding a central opening for receiving a cylindrical
11 component, and an annular seal bounding the central opening of the first end cap for
12 providing a fluid seal with the cylindrical component, a vent orifice in the first end cap
13 into the central cavity of the filter element, and a cooperating orientation means integral
14 with the first end cap and projecting outwardly therefrom, the orientation means of the
15 first end cap having a configuration such that the orientation means on the first end cap
16 cooperates with the orientation means in the housing when the element is fully received
17 therein to rotationally orient the filter element with respect to the housing such that the
18 orifice in the first end cap is in a predetermined rotational position relative to the housing;
19 and

20 a second, circular end cap at the second end of the media ring, the second end cap
21 including retaining means, the retaining means of the second end cap interengaging with
22 the retaining means of the cover to temporarily couple the end cap to the cover when the
23 cover is initially screwed down onto the housing, wherein when the cover is initially
24 screwed down onto the housing, the filter element rotates in conjunction with the cover
25 until the cover is screwed down a predetermined amount, after which the orientation
26 means of the first end cap engages the orientation means of the housing, to rotationally
27 lock the filter element with respect to the housing, the interengagement between the cover
28 and element being such that when the orientation means of the housing and first end cap
29 engage, the cover can thereafter rotate with respect to the filter element as the cover is
30 fully screwed down onto the housing.

1 12. A filter assembly comprising a housing having a threaded open end, a closed end,
2 and a central axis, a first port to direct fluid into the housing and a second port to direct
3 fluid from the housing, the housing including an orientation device integral with an
4 internal surface of the housing and projecting radially inward therefrom; a cup-shaped
5 cover with threads adapted to be screwed down onto the threaded open end of the
6 housing, the cover including a retaining device internally of the cover and projecting

7 radially outwardly therefrom; and a filter element removeably disposed within the
8 housing, the filter element including a ring of filtration media circumscribing a central
9 axis and defining a central cavity, the filtration media ring having a first end and a second
10 end; a first, circular end cap at the first end of the media ring, having an annular body
11 portion bounding a central opening for receiving a cylindrical component, and an annular
12 seal bounding the central opening of the first end cap for providing a fluid seal with the
13 cylindrical component, a vent orifice in the first end cap into the central cavity of the
14 filter element, and a cooperating orientation device integral with the first end cap and
15 projecting radially outwardly therefrom, the orientation device of the first end cap having
16 a configuration such that the orientation device on the first end cap cooperates with the
17 orientation device in the housing when the element is fully received therein to
18 rotationally orient the filter element with respect to the housing such that the orifice in the
19 first end cap is in a predetermined rotational position relative to the housing; and

20 a second, circular end cap at the second end of the media ring, a retaining device
21 integral with the second end cap and projecting outwardly therefrom, the retaining device
22 of the second end cap having a configuration such that the retaining device of the second
23 end cap interengages with the retaining device on the cover to temporarily couple the end
24 cap to the cover when the cover is initially screwed down onto the housing, wherein
25 when the cover is initially screwed down onto the housing, the filter element rotates in
26 conjunction with the cover until the cover is screwed down a predetermined amount, after
27 which the orientation device on the first end cap engages the orientation device on the
28 housing, to rotationally lock the filter element with respect to the housing, the
29 interengagement between the cover and element being such that when the orientation
30 device on the housing and first end cap engage, the cover can thereafter rotate with
31 respect to the filter element as the cover is fully screwed down onto the housing.

1 13. The filter assembly as in claim 12, wherein the retaining device on the cover
2 comprises a rib, ridge or tab, and the retaining device on the second end cap comprises a
3 pair of closely-spaced ribs, ridges or tabs for each retaining device on the cover.

1 14. The filter assembly as in claim 12, wherein the orientation device on the first end
2 cap comprises a rib, ridge or tab and the orientation device on the housing comprises a
3 rib, ridge or tab.